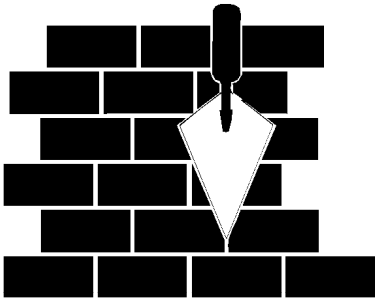
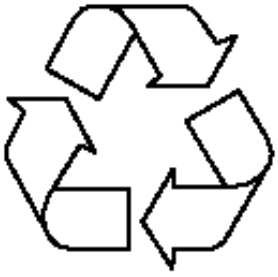
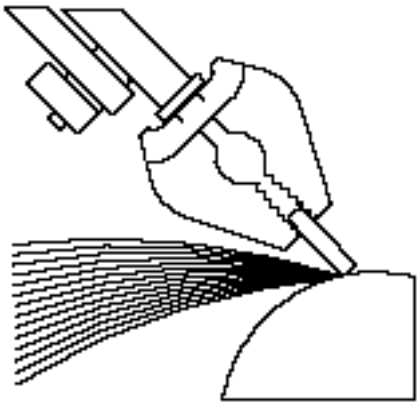
Indiana
Technology Education

http://www.doe.state.in.us/OCTE/technologyed





Course Descriptions Booklet



2004 Edition

INDIANA TECHNOLOGY EDUCATION CURRICULUM

Inside Cover

Technology Education

Course Descriptions Booklet – 2004 Edition

INDIANA TECHNOLOGY EDUCATION CURRICULUM COMMITTEE

Gary Ayers
Avon High School
Indianapolis, IN

Barb Bennett
Evansville / Vand. Co. Schools
Evansville, IN

Jack Davidson (Retired)
Kokomo Senior High School
Kokomo, IN

Michael Fitzgerald
Department of Education
Indianapolis, IN

Jim Genovese
Valparaiso High School
Valparaiso, IN

Anthony Gilberti
Indiana State University
Terre Haute, IN

Randy McGriff
Kesling Middle School
LaPorte, IN

Pat O'Rear (Retired)
New Albany High School
New Albany, IN

Deb Seeley
Fegley Middle School
Portage, IN

Richard Seymour
Ball State University
Muncie, IN

Bob Sexton
Seymour High School
Seymour, IN

Gregg Steele (Retired)
Department of Education
Indianapolis, IN

Terry Thompson
MSD of Wayne Township
Indianapolis, IN

Rob Weisbach
Decatur Central H.S.
Indianapolis, IN

Scott Warner
Ball State University
Muncie, IN

Gary Wynn
Greenfield Central H.S.
Greenfield, IN

Ronald Yuill
Tecumseh Middle School
Lafayette, IN

COURSE DESCRIPTIONS GUIDE REVISION TEAM

Michael Fitzgerald
Department of Education
Indianapolis, IN

Richard Seymour
Ball State University
Muncie, IN

Gregg Steele (Retired)
Department of Education
Indianapolis, IN

Editor:

Richard Seymour
Ball State University
Muncie, IN

Technology - A Perspective

The evolution of humankind is often presented as a series of wars, religious disputes, new laws, and the division of territories into countries. However, in reality, most history is a record of people adapting to the natural and human-made environment. It is the story of inventions and innovations; of people developing and using tools and materials in their struggle to make their life easier and more enjoyable.

The early development of technology occurred in several arenas. People learned to tame and use fire, develop stone weapons, process skins into leather, produce ceramic containers, weave cloth, and construct dwellings. This led to the combination of technologies which resulted in rapid change.

These and other developments transformed the face of the earth. While the earliest changes were almost imperceptible, we now live in a human-designed and human-built world. As the national content standards document remind us, technology has led to the "modification of the natural environment to satisfy perceived human needs and wants" (ITEA 2000, p. 242).

Technology Defined

This ever-present, unavoidable, potentially beneficial phenomena, called "technology", is widely misunderstood, misdefined, and often distrusted. To some people, *technology is hardware.* It is computers, the Internet, lasers, and supersonic aircraft. To other people, *technology is organization*. It is the way people structure themselves to produce products and services. To still other people, *technology is process.* It is the actions used in developing, producing, and managing our products or systems on a daily basis.

This last view is the most global and most descriptive. It suggests that ***technology is a body of knowledge and action, used by people, to apply resources in developing, producing, using, and assessing products, structures and systems in order to control and modify the natural and human-made (modified) environment.***

The Project 2061 report (Johnson, 1989) captured the essence of technology by suggesting that it is "the application of knowledge, tools, and skills to solve practical problems and extend human capabilities." (p. 1) The report further suggested that technology "is conceived by inventors and planners, raised to fruition by the work of entrepreneurs, and implemented and used by society."

More recently, the *Standards for Technological Literacy* (ITEA, 200) included a simplified notion, stating that technology is "human innovation in action". Modern technology involves many processes and actions, and can help humans solve basic problems while extending human capabilities.

The Actions Of Technology

Wherever there are humans, technology is present. Technology is applied as humans grow and harvest food and fibers, locate and extract natural resources, diagnose and treat illnesses, explore the universe, participate in recreation and entertainment activities, make war, erect dwellings, move cargo, teach each other, investigate the world around them, etc. Without technology, humans could not exist.

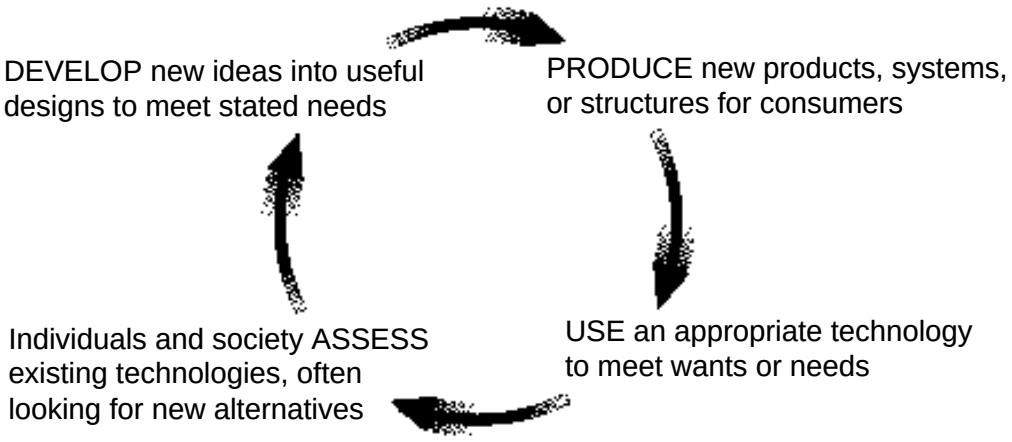
Technology can easily be viewed as a set of unique actions which include:

- **Developing:** Creating brand new or modifying existing devices, structures, and systems to meet human needs and wants.
- **Producing:** Acquiring resources to make products, structures, and systems available for human use.
- **Using:** Applying technology to meet daily needs and wants.
- **Assessing:** Determining the appropriateness of technological actions by evaluating their impacts on all individuals, society, and the environment.

These actions are often displayed using a systems model. The Jackson's Mill work (Hales and Snyder, n.d.) described a system as a combination of elements or parts that work in an orderly, predictable way to accomplish a desired goal. The document presented the "universal systems model" as having inputs, processes, outputs, and a feedback loop. This model suggests that labor, materials, energy, and other resources are used in technological systems to solve problems and address opportunities. These resources are applied through various technological processes to provide desired outputs (but often include ancillary outputs, as well). The outputs of the systems are evaluated and the information obtained is used as feedback to control the operation of the system.

TECHNOLOGICAL ACTIONS

Based on human needs & wants, technological resources are required to . . . .



. . . . when solving problems or addressing opportunities.

Technology Education

Technology education, a fairly recent addition to the school curriculum, focuses on this technological knowledge and competence. It is designed to help students understand and to participate in the technological society today and tomorrow. As outlined in the *Standards for Technological Literacy*, technology education "provides an opportunity for students to learn about the processes and knowledge related to technology".

To meet these challenges, a technology education program has been developed for Indiana. It is described as:

An action-based program for all students to learn how to develop, produce, use, and assess the impacts of products and services that extend the human potential to improve and control the natural and human-made environment.

Each student who participates in the program will develop an understanding of technology as a system in the global context by developing an ability to . . . .

- Develop technological products and services.
- Use tools, machines, materials, and energy to produce products /services.
- Select appropriate technology to solve problems and meet opportunities.
- Appropriately use technology to extend human potential to improve and control our environment.
- Assess the impacts of technology on individuals, society, and the environment.
- Use appropriate personal and interpersonal skills to participate in a technological society.

To reach these goals, the program is based on the actions that are universal for all technologies. The total curriculum addresses these two key aspects:

- The specific actions used in developing, producing, using, and assessing all technologies.
- The contexts where technology is developed and used. This includes the areas documented in the national content standards document for the profession (i.e., the *Standards for Technological Literacy*, ITEA 2000).

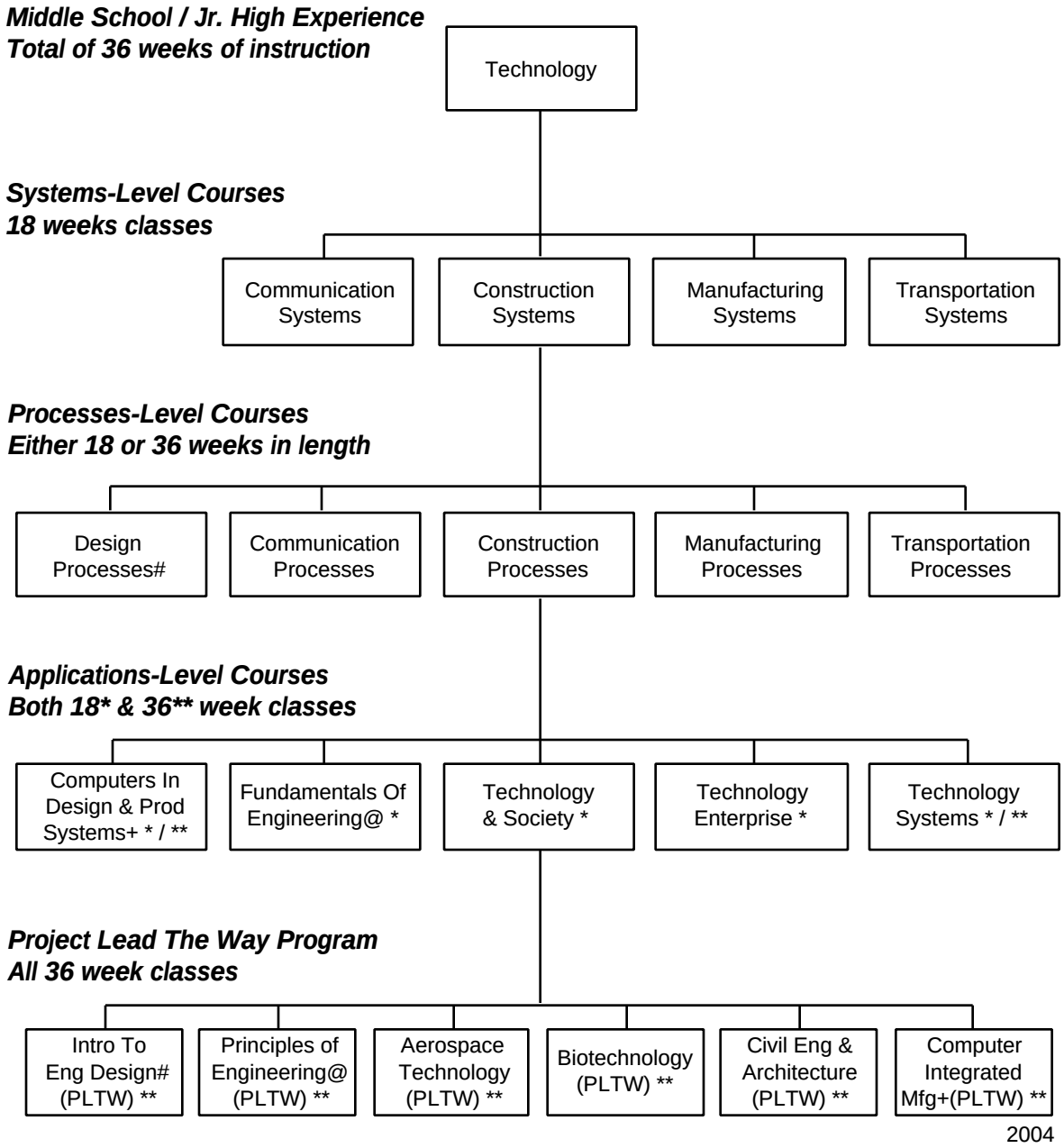
Technology Education In Indiana

The Indiana Board of Education has approved a series of course titles under the major heading of Technology Education (see model on the next page). Course descriptions for the courses associated with the Indiana Technology Education curriculum are contained in this booklet. A separate course guide exists for fourteen of the fifteen Indiana titles. NOTE: There is no state guide for Computers In Design and Production Systems as it is to be a locally developed class.

With the appropriate training, Indiana secondary schools may also offer several of the engineering-based Project Lead The Way (PLTW) courses. Details about the PLTW curriculum can be found on pages 29-30 of this booklet and at the following website:

http://www.pltw.org

INDIANA TECHNOLOGY EDUCATION CURRICULUM



IMPORTANT NOTES: All six Project Lead The Way (PLTW) courses are full year (36 week) experiences. Students may earn credit for either a PLTW course in Design#, Engineering@, and Computers+ or the equivalent Indiana T.E. course, but not both. In addition, PLTW course titles of **Digital Electronics** and **Engineering Design and Development** are approved titles for Indiana schools (and appear under the Multidisciplinary Category of the Indiana Dept. of Education guidelines).

Technology (Middle School or Junior High Experience)
36 total weeks

"Technology" is the approved course title for the introductory experience at the Middle School / Junior High School level. This course introduces students to the world of technology . . . . . the body of knowledge and actions, used by people, to apply resources in designing, producing, and using products, structures, and systems to extend the human potential for controlling and modifying the natural and human-made (modified) environment.

This perspective suggests that technology is a system and involves major actions such as designing, producing, evaluating, and using technology. These four technological actions are universal for all technologies. They can be viewed from a human productive activity approach of communication, construction, manufacturing, and transportation.

All technology impacts and is impacted by historical, economic, social, cultural, and environmental contexts. Only when technology is viewed in relationship with the setting in which it operates, can a realistic understanding be developed.

Suggested Sequence For Implementing The Introductory–level Experience In A Middle School Versus Jr. High School Program

MIDDLE SCHOOL PROGRAM

GRADE 6

What Is Technology?	Impacts Of Technology

GRADE 7

Resources / Technology	Developing Technology

GRADE 8

Mfg	Comm	Trans	Constr	Systems

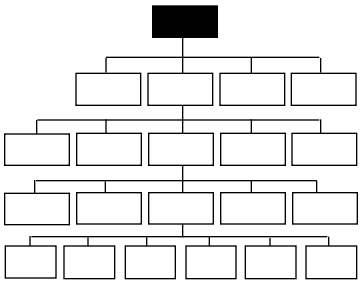
JUNIOR HIGH SCHOOL PROGRAM

GRADE 7

What Is Technology?	Resources / Technology	Impacts Of Technology

GRADE 8

Developing Technology	Mfg	Comm	Trans	Constr	Systems



Technology (Introductory Experience)
36 total weeks*

Course Description

An introductory activity-based course in which students are introduced to the importance of technology and the principles used to design, produce, use and assess it. The students develop both individual and group abilities needed to participate in and contribute to society.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**What Is Technology?** Technological development Designing, producing, and using modern technologies	**30**
2 (or 3*)	**Impacts Of Technology** Assessing technology Personal, environmental, and societal impacts	**30**
3 (or 2*)	**Resources In Technology** Types of resources	**30**
4	**Developing Technology** Design process Developing and testing solutions Specifying solutions	**30**
5	**Manufacturing Technology** Materials and processing techniques Types of production systems Designing and producing products	**12**
6	**Communication / Information Technology** Communication via technical means Graphic and electronic media	**12**
7	**Transportation Technology** Modes of transportation Vehicular and support systems	**12**
8	**Construction Technology** Types of structures Designing and using structures	**12**
9	**Technology & Systems** Technological systems Interdisciplinary nature of technology	**12**

This calendar is designed the be separated into three 12-week classes for middle school programs (6th, 7th, and 8th grades) or split into two 18-week classes for junior high schools* (7th and 8th grades).

Courses In Communication / Information Technology

Communication technology, over the years, has helped people exchange information and ideas. It has allowed people to grow intellectually, express feelings, and better understand diverse cultures.

Communication Systems (18 weeks)

Early human communication was based on crude phrases and artistic techniques such as cave paintings and sculpture. As civilization grew, more efficient communication methods were needed. Language, illustration techniques, and other means of signaling were developed. This need influenced the development of technical means such as the printing press, screening printing techniques, and eventually electronic media. Both electrical and electronic communication opened the world to rapid information exchange.

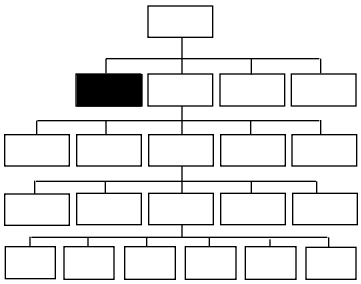
All communication / information systems can be described by using a simple model of the communication process that includes these elements:

- Sender
- Encoder
- Channel
- Decoder
- Receiver
- Storage
- Retrieval
- Interference

Communication Processes (18 or 36 total weeks)

The Communication Systems course is designed to introduce students to the world of communication technology through a variety of presentations, discussion, and laboratory activities. Most activities in this course are designed for small group work. This is especially appropriate since communication takes place between two parties or machines. Therefore, the media must be prepared (coded) for exchange, received at a distant point, and made understandable (decoded) by the receiving party or machine.

The Communication Processes course expands topics found in the Systems class, as students review the world of information and communication technology. Most activities in the Communication Processes course are related to multi-media applications, some computer-based and others involving video cameras and digital equipment. The opportunity exists to explore topics such as automation, desktop publishing, and other forms of documentation creation and reproduction during the 36 week course.

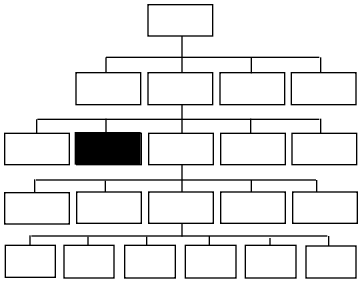


Communication Systems
18 weeks

Course Description

A broad course that explores the application of tools, materials, and energy in designing, producing, using and assessing communication systems. Students will produce graphic and electronic media as they explore techniques used to apply technology in communicating information and ideas.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Introduction to Communication Technology** Exchanging ideas and information Individual versus mass communication The communication process Evolution of communication technologies	**10**
2	**Designing and Assessing Media / Products** Media design techniques Graphic layout Evaluating communication media	**15**
3	**Visual (Imaging) Systems** Types of photographic systems Image manipulation Formats Output techniques	**15**
4	**Audio Communication Systems** Designing audio messages Recording techniques Producing and editing messages	**10**
5	**Graphic Reproduction Systems** Planning print media Desktop publishing Screen process printing techniques	**15**
6	**Telecommunication Systems** Fundamentals of electronic systems Producing electronic media messages	**15**
7	**Internet-based Communication** Designing media for the Internet Producing messages for the WWW Evaluating electronic media	**10**



Communication Processes
18 or 36 weeks

Course Description

A specialized course that explores the technological processes used to produce and deliver both graphic and electronic media.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**Introduction to Communication Processes** Communication process and systems Audience assessment Individual vs. mass communication	**10**	**10**
2	**Communicating with Technical Graphics** Sketching Technical drawings CADD	**20**	**30**
3	**Designing / Producing Printed Media** Image design, generation, and assembly Desktop publishing	**15**	**30**
4	**Designing / Producing Photographic Messages** Planning photographic messages Cameras and film Digital photography Editing and printing techniques	**15**	**20**
5	**Designing / Producing Electronic Messages** Classification of electronic systems Waves, frequencies, wave lengths and motions Generating and amplifying electronic signals Operating transmitters and receivers Design of electronic messages Casting, preparing scripts, staging, props, etc. Recording audio / audio-video messages	**20**	**40**
6	**Communication & The Future** Emerging technologies	**10**	**20**
7	**Design Problem**	**0**	**30**

Courses In Construction Technology

Construction technology involves using resources efficiently to produce a structure on a site. Construction projects include residential and commercial buildings and heavy engineering projects.

Construction Systems (18 weeks)

The introductory course was designed to explore the application of tools, materials, labor, and energy in designing, producing, using, and assessing constructed works. Students will explore the techniques used in producing residential, commercial, and industrial buildings.

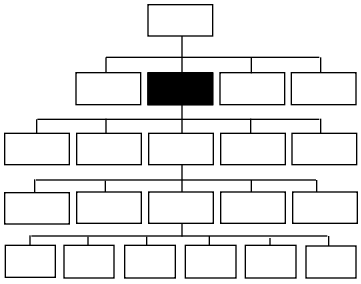
A standard constuction sequence is introduced in the initial course. The activities in the course are designed to highlight these steps:

- Designing the structure — includes all the practices that take place to convert an idea into a project.
- Producing a building / structure — includes both managing the project and doing the actual construction work.
- Using constructed structures — begins after the project ownership has been transferred.
- Assessing construction thorough community planning — explores how industrial, commercial, agricultural, and residential components combine to form a community.

Construction Processes (18 or 36 total weeks)

In the Construction Processes course, students would have an opportunity to explore the world of construction in more detail. Entire structures could be designed, built, and tested. While modeling techniques are common in the initial course, actual structures might be built in the follow-up course. This allows students to work with concrete blocks, studs, shingles, electrical components, and other building materials.

If the Construction Processes course were offered for a full year, a major unit in community planning would allow students to study and offer suggestions for improving the infrastructre or systems in their neighborhood. This type of work is generally associated with a community development office or regional planning commission.

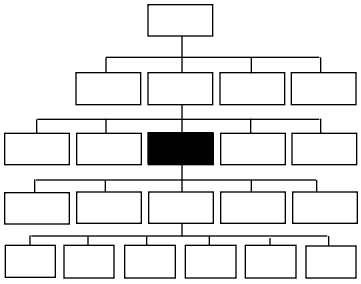


Construction Systems
18 weeks

Course Description

A broad course that explores the application of tools, materials, and energy in designing, producing, using and assessing constructed works. Students will explore techniques used to apply technology in producing residential, commercial, and industrial buildings and a variety of civil structures.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Introduction to Construction Technology** The laboratory, tools, and materials Types of construction Buildings and civil structures Designing, producing, using, assessing Problem solving in construction	**10**
2	**Designing Structures** Designing construction projects Building codes Preparing working drawings Writing specifications	**20**
3	**Buildings Construction** Initiating the project Site work Building the structure Installing systems Enclosing and finishing	**30**
4	**Constructing Civil Structures** Initiating the project Site work Building the structure Enclosing and finishing Construction techniques	**15**
5	**Using Constructed Structures** Selecting a structure Using and maintaining structures	**10**
6	**Community Planning** Assessing communities What is a community?	**5**



Construction Processes
18 or 36 weeks

Course Description

A specialized course that explores the technological processes used to produce residential, commercial, and industrial buildings and a variety of civil structures.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**Introduction to Construction Processes** What is technology? Types of construction Construction personnel	**5**	**5**
2	**The Design Process for Construction** Architectural drawings Specifications and contracts	**20**	**30**
3	**Purchasing and Financing Structures** Determining needs / wants Selection criteria Purchasing financial options	**5**	**5**
4	**Managing and Organizing Construction** Planning / organizing jobs Control techniques	**5**	**5**
5	**Construction Materials and Tools** Construction tools Construction materials	**10**	**15**
6	**Construction Techniques** Preparing sites and setting foundations Erecting superstructures Installing utilities and systems Finishing interiors and exteriors Completing sites	**25**	**30**
7	**Maintaining and Re–using Structures** Maintaining structures and systems Repairing structures and systems	**20**	**30**
8	**Community Planning** Describing and analyzing communities Developing and presenting community plans	**0**	**60**

Courses In Manufacturing Technology

Manufacturing is the fabrication, assembly, and packaging of products in an established facility, with the completed goods sent to another location for use. The moving of the "final output" to another location differentiates construction from manufacturing activities.

Manufacturing Systems (18 weeks)

Manufacturing Systems provides students with an introduction to manufacturing technology and its relationship with society, individuals, and the environment. An understanding of manufacturing provides a base for technological literacy and competence. This understanding is developed through the study of the two major technologies used by all manufacturing enterprises — material processing and management technology.

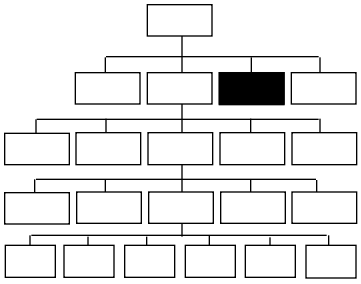
The units in the introductory course are organized to introduce the students to the exciting world of manufacturing. This allows them to study engineered materials plus the primary and secondary processes used to convert raw materials into finished products.

The Manufacturing Systems course also includes a study of the various managed activities which are used to develop, produce, use, and assess production technology. Research and development, production, and marketing techniques are reviewed. In addition, the outputs are studied in terms of using and assessing the completed goods and the impacts of production on society, individuals, and the environment.

Manufacturing Processes (18 or 36 total weeks)

The Manufacturing Processes course helps students learn about a wide variety of production techniques. Fabrication and assembly steps are highlighted early in the course. The means of assuring product quality are also explored. These topics are introduced in the context of custom and intermittent (batch) production.

Both the 18 and 36 week versions of the Manufacturing Processes course include a unit in automation. Desktop workstations can be used to review computer-directed production techniques. The full year course allows more time in this area, plus the opportunity to establish a "job shop" style of production system.

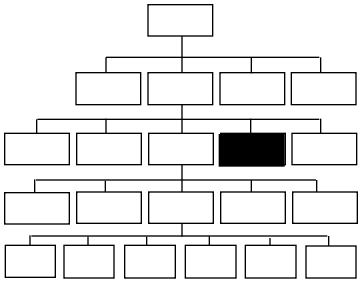


Manufacturing Systems
18 weeks

Course Description

A broad course that explores the application of tools, materials, and energy in designing, producing, using and assessing manufactured products. Students will explore techniques used to apply technology in obtaining resources and in changing them into industrial materials and finished products.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Introduction to Manufacturing Technology** Manufacturing and its impacts on society Sample production activity	**10**
2	**Manufacturing Materials** Types of materials Properties of materials	**10**
3	**Manufacturing Processes** Obtaining resources Casting and molding processes Forming processes Separating processes Conditioning processes Assembling processes Finishing processes Automation of industrial processes	**30**
4	**Developing and Producing Products** Design process Communicating designs Engineering the product ideas Engineering the manufacturing systems Developing quality control systems Obtaining human and material resources Marketing the product	**20**
5	**Using and Assessing Materials / Products** Using and evaluating materials and products Recycling techniques	**10**
6	**Manufacturing and the Future** People and skills International markets Emerging technologies	**10**



Manufacturing Processes
18 or 36 weeks

Course Description

A specialized course that explores the technological processes used to obtain resources and change them into industrial materials and finished industrial and consumer products.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**Introduction to Manufacturing Processes** Manufacturing materials and processes Industrial classifications of processes	**5**	**5**
2	**Manufacturing Materials** Manufacturing materials Material properties and characteristics Destructive and nondestructive testing	**15**	**20**
3	**Fabrication Operations** Casting processes Forming processes Separating processes Conditioning processes Other	**30**	**45**
4	**Assembling and Finishing Tasks** Principles of assembling processes Performing assembling processes Principles of finishing processes Performing finishing processes	**15**	**20**
5	**Maintaining Quality / Standards** Quality assurance versus control Inspection ISO standards	**15**	**20**
6	**Automating Processes** Principles of automating processes Performing automating processes Using and assessing automating processes	**10**	**40**
7	**Applying Manufacturing Processes** Principles of designing Performing design techniques	**0**	**30**

Courses In Transportation Technology

Transportation is a common human activity, as we explore and travel on a daily basis. Over the ages we have developed new and more efficient techniques to move people and cargo from one location to another. Early developments were restricted to natural routes—animal trails and waterways. More complex land transportation systems followed with rail, roadway, and pipeline systems being developed. Also, shipping moved from sail-powered, wooden boats to steel-hulled craft powered by powerful engines. In the 1900s air transportation supplemented the basic land and water systems. Today we are using space transportation systems to deliver large satellites into orbital positions and to also explore our universe from outer space.

Transportation Systems (18 weeks)

Transportation is essential for societal development. Commerce is based on the rapid, efficient movement of goods and people. Many recreational activities depend on the ability to travel to distant locations. Various jobs require people to travel to customers, construction sites, and other points of activity. Giant warehouses and production facilities require miles of conveyors and specialized transportation systems.

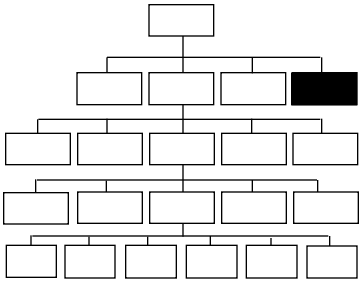
Technological literacy requires an understanding of the technical means people use to extend the ability to move themselves and goods to various locations. The introductory course called Transportation Systems is designed to provide a basic understanding of modern transportation. Students will be given the opportunity to view transportation as a system, then investigate the systems used to move people and goods on land and water, through the earth's atmosphere, and into space.

Transportation Processes (18 or 36 total weeks)

The Transportation Processes course is broken into two parts, focusing on the movement of goods (cargo or freight) and people (drivers, passengers, crew, etc.). While many elements of these systems are similar, there are also vast differences that make them quite unique. For instance, sending astronauts into space requires a completely different vehicle as compared to the robotic interplanetary explorers that are sent out to explore the universe. The same scenario applies to other transportation activities, as the loading and unloading of passengers is much different than the handling of bulk cargo or small parcels.

The full year version of the Transportation Processes course includes a unit where students might complete a vehicle or system for a competitive event (such as the IMSTEA Supermileage Challenge or a solar vehicle design contest). A list of competitive events can be found at this pageon the Indiana DOE website:

http://www.doe.state.in.us/octe/technologyed/contests.html

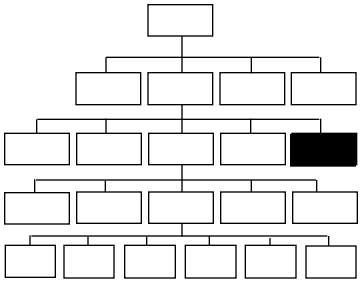


Transportation Systems
18 weeks

Course Description

A broad course that explores the application of tools, materials, and energy in designing, producing, using and assessing transportation systems. Students will explore systems and techniques used to apply technology to move people and cargo in vehicles and by other means on land and in water, air, and space.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Introduction to Transportation Technology** What is transportation Types of systems Transportation model	**10**
2	**Transportation Environments** Land–based systems Water / marine systems Air–based systems Space systems Intermodal	**20**
3	**Vehicular Systems** Structure Propulsion Guidance Control Suspension Support	**35**
4	**Developing Transportation Systems** Vehicles and systems Terminals and guideway Routes and schedules Energy use	**10**
5	**Operating Transportation Systems** Routing Loading / Unloading Moving Storing	**10**
6	**Using and Assessing Transportation Systems** Selecting and using Evaluating and assessing	**5**



Transportation Processes
18 or 36 weeks

Course Description

A specialized course that explores the technological processes used to move people and cargo in vehicles and by other means on land and in water, air, and space.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**Introduction to Transportation Processes** Transportation systems Environments of motion Transportation process model Governance and regulations	**10**	**10**
2	**Planning / Routing / Navigating** Establishing routes Scheduling Physical distribution Tracking shipments	**15**	**30**
3	**Transporting cargo / freight** Types of cargo and systems Transportation equipment Special requirements Routing Loading operations Moving Unloading	**25**	**25**
4	**Transporting humans** Moving individuals / passengers Transportation equipment Special requirements Routing / Scheduling Loading Moving Unloading	**25**	**25**
5	**Transporting and the future** Moving cargo/passengers Specific environmental issues	**15**	**30**
6	**Applying Transportation Processes** Design and problem solving	**0**	**50**

Courses In Design and Engineering

Technology is the result of purposeful action. All technology started in someone's mind as a concept or mental construct. Usually the ideas are linked to an opportunity or a problem needing a solution. A technological solution was then developed to meet the problem or address the opportunity. A number of techniques are used to develop technology including innovation, invention, design, and engineering.

A common technique studied in technology education is problem solving. Dr. Walt Waetjen (ITEA, 1989) suggested that this process had six steps: (1) Define the problem, (2) Re-form the problem, (3) Isolate the solution, (4) Implement the plan, (5) Restructure the plan, and (6) Synthesize the solution. The Conceptual Framework Project document (Savage and Sterry, 1990) described the same process as including (1) Defining the problem, (2) Developing alternate solutions, (3) Selecting a solution, (4) Implementing and evaluating the solution, (5) Redesigning the solution, and (6) Interpreting the solution. Likewise, four similar goals (i.e., identifying needs and opportunities, generating a design, planning and making, and evaluating) appear in the British Design and Technology program.

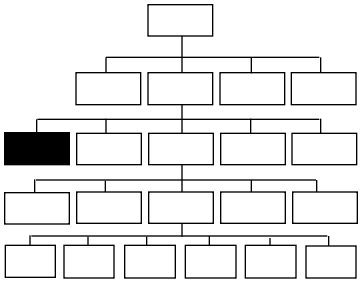
In addressing issues and challenges, a new design typically evolves. This design might be a structure, piece of graphic media, new product, or an engineered transportation system. Two courses in the Indiana T.E. program focus exclusively on design and engineering.

Design Processes (18 or 36 total weeks)

The Design Processes course will allow students to explore the actions used to develop products, structures, and systems to meet human needs and wants. They will identify problems, generate alternate solutions, refine the most plausible solution, develop specifications for the selected solution, model and test the solution, and present the final solution for approval. Through this study the common principles of technological design will be explored and reinforced.

Fundamentals of Engineering (18 weeks)

The Fundamental of Engineering class adds scientific and mathematical principles to the design and problem solving scenario. We typically think of an engineer as a highly educated and trained problem solver who engages in the functions of engineering through formal research, development, planning, design, and project management. Engineers often work as a part of a team to plan, design, and supervise a project from concept to completion. This Indiana Technology Education course is designed to provide students an opportunity to explore various fields of engineering (such as civil , mechanical, and materials engineering). Engineering ethics and the impacts of engineering decisions will also be addressed.

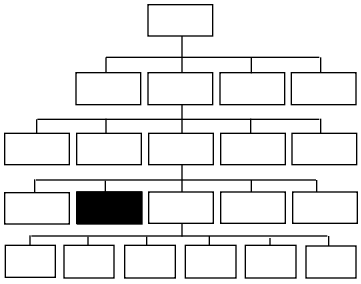


Design Processes
18 or 36 weeks

Course Description

A specialized course that explores the technological processes and employs creative problem solving in developing, engineering, testing, and communicating designs for products, structures, and systems.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**Introduction to Design Processes** The designed world The steps in solving a problem	**10**	**10**
2	**Thinking Skills of Designing** Creativity Perspectives & attitudes	**10**	**10**
3	**Documenting and Presenting Design Work** Designer's portfolio Line, shape, form, & color Sketching and drawing	**15**	**30**
4	**Problems and Opportunities**	**5**	**5**
5	**Investigation and Research** Human factors engineering	**5**	**10**
6	**Generating Alternative Ideas** Brainstorming	**5**	**5**
7	**Choosing The Best Solutions**	**5**	**5**
8	**Development Work**	**5**	**10**
9	**Modeling and Prototypes** Graphic and verbal communications Presenting solutions	**15**	**15**
10	**Testing and Evaluating** Conducting tests and evaluating results Redesigning and improving	**5**	**20**
11	**Presenting Solutions**	**10**	**10**
12	**Designing Systems** Structural / mechanical / pneumatic / electronic	**0**	**50**



Fundamentals of Engineering
18 weeks

Course Description

This course will focus on the actions and processes of engineering as found in the design and application of materials, mechanisms, products, structures, and systems.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**What is Engineering?** Engineering and society Engineering and ethics Engineering and the environment	**5**
2	**Problem Solving & Design** Design process Problems and opportunities Ergonomics	**7**
3	**Tools of Engineering** Computer applications The science of measurement Sketching, multi-view, and pictorial drawings Technical reporting	**8**
4	**Material Science** Structure and properties of materials Processing materials Material testing	**10**
5	**Mechanisms, Controls, and Automation** Mechanical systems Fluid systems Electric / electronic systems CIM, CNC, and control technologies	**15**
6	**Structures** Types and uses of structures Forces, loads, and related elements	**5**
7	**Energy Systems** Forms of energy Controlling energy	**20**
8	**Applications of Engineering Concepts** Design competitions and problems	**5**

Application-level Experiences In Technology

Technology is more than mere machinery or industrial processes or complex systems. Technology is a pervasive force that is interwoven in the cultural, social, business, political, and intellectual activities of all people. It has many characteristics and settings. Therefore several applications-level courses have been added to the T.E. program to help students explore specific topics related to technology.

Technology Systems (18 or 36 weeks)

The course called Technology Systems is a study of the technologies used in modern engineering, information systems, health and human service professions, and various occupations related to the humanities. Throughout this course problem-solving activities address real-world problems and opportunities. Computer experiences incorporate graphics, simulation, networking, and control systems.

Technology & Society (18 weeks)

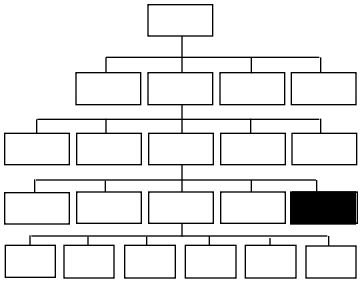
As technologies become more powerful and integrated across societies, the ability to foresee the social, economic, and environmental consequences of their development has become increasingly critical. The course called Technology and Society should increase student awareness of the uncertainties and future direction associated with technological developments. Emphasis is given to the nature of technology, the impact of devices and systems on the quality of life, assessing the benefits and risks of technology, and technological ethics. The class and laboratory activities have been structured to allow students to focus on their roles in the management and control of technology.

Technology Enterprise (18 weeks)

With the global desire for new products and services, enterprises strive to meet these human needs with quality goods, structures, and services. In a competitive marketplace, today's enterprises must be developed and operated in an efficient manner. That is the goal of the Technology Enterprise class . . . structuring and operating a real–life enterprise in a classroom environment. This class will help students understand the reasons for and the way modern technology-based enterprises are organized and operated.

Computers In Design & Prod. Systems (18 or 36 weeks)

Finally a course title has been added to the Indiana T.E. program to allow schools to develop computer-based class that addresses local needs. This class will be structured differently in each school. Suggested themes to highlight in during this class include automation, computer-aided design, and desktop publishing.

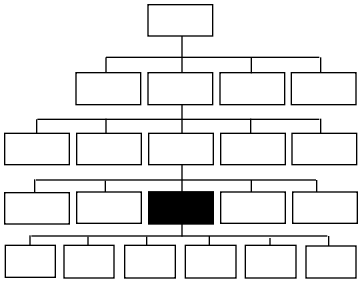


Technology Systems
18 or 36 weeks

Course Description

A study of the technologies used in industrial, business, and human service occupations. Creative problem solving activities address current, real world conditions. Computer experiences incorporate graphics, simulation, and control systems.

Unit Number	Course Outline (Unit Title and Content)	Time (Days) 18-week	36-week
1	**What is Technology?** Examples of technology The evolution of technological progress Technology and career clusters	**10**	**30**
2	**Technology as a System** Types of technological systems Goals/objectives System inputs, processes, and outputs Feedback	**20**	**20**
3	**Designing Technological Devices and Systems** Problem solving and the design process Investigation and research Generating alternative solutions Developing workable solutions Communicating a technological solution	**25**	**40**
4	**Technological Systems** Developing a system Producing a system Using a system Assessing systems	**25**	**40**
5	**Impacts of Technology** Desirable versus undesirable outcomes Environmental and social issues	**5**	**20**

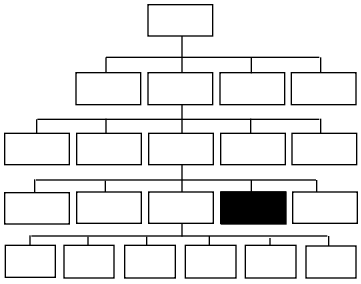


Technology & Society
18 weeks

Course Description

This course is designed to provide students with an opportunity to understand the interactions of science, technology, and society and use the knowledge gained as a guide to responsible decision making.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Technological Development** History of technology Triggers of technological change Inventions and their impact Resources and global influence Alternative views of progress	**15**
2	**The Nature of Science and Technology** Defining science and technology in modern society Use of knowledge to address problems and opportunities Technology and the quality of life Dependency on technological systems in meeting needs	**10**
3	**Technology and Change** The power of modern and emerging technology The irreversibility of technological change Social and cultural consequences Evaluating various technological systems Environmental consequences	**10**
4	**Technology and Ethics** Social and technological efficiency Civic responsibility Decision–making	**10**
5	**Social, Cultural, and Environmental Consequences** Problems related to technological development Studies of planned and existing projects Assessing technological conditions	**20**
6	**Managing our Technological Future** Technology assessment Technological forecasting	**20**

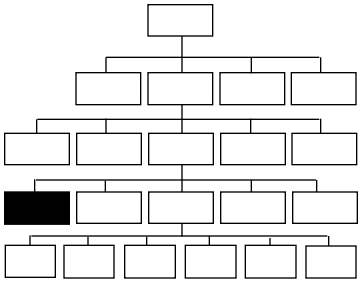


Technology Enterprise
18 weeks

Course Description

A synthesis course that allows students to apply technological and managerial principles in organizing, financing, and operating a company to produce a product, structure, or service.

Unit Number	Course Outline (Unit Title and Content)	Time (Days)
1	**Introduction to Productive Enterprises** Types of enterprises Management techniques Differences between producing services and products Competitive nature of a global marketplace	**15**
2	**Management** Ownership Levels of authority Responsibilities of management Team building Labor unions	**5**
3	**Developing Products and Services** Identifying human needs and wants Generating and revising ideas Proposing and reviewing potential designs Presenting developed ideas	**20**
4	**Organizing an Enterprise** Developing the organizational structure Incorporating an enterprise Raising funds Staffing and scheduling activities Human resources development	**5**
5	**Operating the Enterprise** Day–to–day operations of an enterprise Production and quality control Financial record–keeping	**30**
6	**Delivering / Marketing the Product or Service** Promoting and selling the product / service Distribution	**10**
7	**Closing an Enterprise** Dissolving the company	**5**



Computers In Design & Production Systems
18 or 36 weeks

Course Description

This course focuses on using computer systems in producing drawings and related documentation for products and structures and in controlling automated production systems. The emphasis is placed on using modern computer applications rather than on developing job skills.

NOTE: The content and activities for this course is to be developed locally in accordance with available computer systems in the school. There are no statewide standards for computer hardware and software, so it would be impossible to account for the diversity of computer systems and versions of software found around the state. Therefore, no curriculum guide is available for this course.

It is hoped that Indiana's technology eductors implement this course and use the class to address major themes such as:

- Design documentation using CAD systems
- Assignments that involve the interface of CAD, CAM, and CIM technologies
- Computer simulation of products and systems
- Animation and related multimedia applications
- Internet-based applications
- Control technologies
- Automation in the modern workplace
- Computers in information (networked) systems
- 3-D modeling of products or structures
- Publishing of various media
- Digital creation and editing of graphics and audio files

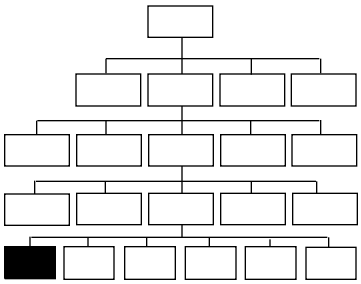
An Indiana secondary school student can receive a maximum of two (2) semesters of credit under this course description.

National Alliance for Pre-Engineering Programs

Project Lead The Way™ Curriculum

Project Lead The Way, Inc. (PLTW) is a national pre-engineering program forming partnerships among schools, higher education, and the private sector. The major goal is to increase the quantity and quality of engineers and engineering technologists nationwide. PLTW has a support staff of experienced technology educators plus college and university partners to assist public schools wishing to implement the PLTW program. For more information, their website is: http://www.pltw.org

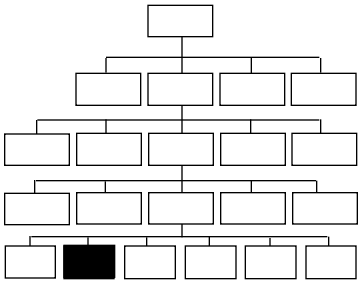
Following state guidelines, students may obtain credit for a PLTW course in the six courses outlined on this and the next page. In addition, PLTW titles of **Digital Electronics** and **Engineering Design and Development** are approved titles under the Multidisciplinary Category of the guidelines for Indiana public schools.



Introduction to Engineering Design
36 weeks

Course Description

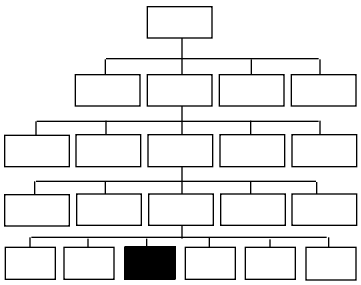
This Project Lead The Way course develops student problem-solving skills using a design development process. Models of product solutions are created, analyzed and communicated using solid modeling computer design software.



Principles of Engineering
36 weeks

Course Description

This course helps students understand the field of engineering and engineering technology by exploring various technology systems and manufacturing processes. Students learn how engineers and technicians use math, science and technology in an engineering problem solving process to benefit people. The course also includes concerns about social and political consequences of technological change.

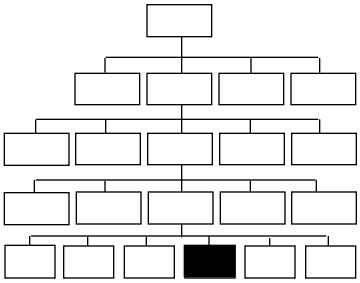


Aerospace Technology
36 weeks

Course Description

This PLTW course will provide students with the fundamental knowledge and experience to apply mathematical, scientific, and engineering principles to the design, development, and evaluation of aircraft and space vehicles, and their operating systems. Emphasis should include the investigation of flight characteristics, analysis of aerodynamic design, and the impact of this technology on the environment.

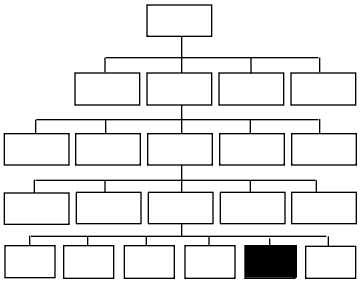
Three additional Project Lead The Way (PLTW) course titles approved under the academic category of "Technology Education" in Indiana. Note: Only schools having a signed agreement with the national Project Lead The Way organization can implement PLTW courses.



Biotechnology
36 weeks

Course Description

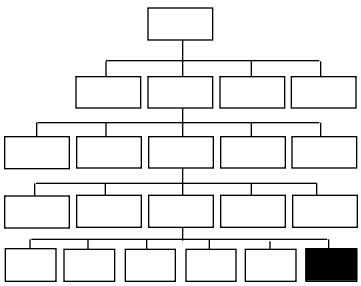
This Project Lead The Way course will introduce the fundamental aspects of biotechnology and the engineering technologies related to this emerging field. Instruction will emphasize how engineering and technology processes can be used to create new products. Engineering principles will be used in conjunction with scientific knowledge to explore and investigate such areas as biomedical devices, pharmaceutical and medical therapies, and agricultural research and development.



Civil Engineering & Architecture
36 weeks

Course Description

This Project Leads The Way course will introduce students to the fundamental design and development aspects of civil engineering and architectural planning. Application and design principles will be used in conjunction with mathematical and scientific knowledge. Computer software should allow students to design, simulate, and evaluate the construction of buildings and communities. During the planning and design phases, instructional emphasis should be placed on related transportation, water resources, and environmental issues.



Computer Integrated Manufacturing
36 weeks

Course Description

This PLTW course applies principles of rapid prototyping, robotics and automation. Students use CNC equipment to produce actual models of their three-dimensional designs. Fundamental concepts of robotics used in automated manufacturing and design analysis are included.

Policy Notification Statement

It is the policy of the Indiana Department of Education not to discriminate on the basis of race, color, religion, sex, national origin, age, or disability, in its programs, activities, or employment policies as required by the Indiana Civil Rights Law (I.C. 22-9-1), Title VI and VII (Civil Rights Act of 1964), the Equal Pay Act of 1973, Title IX (Educational Amendments), Section 504 (Rehabilitation Act of 1973), and the Americans with Disabilities Act (42 USCS §12101,et. seq.).

Inquiries regarding compliance by the Indiana Department of Education with Title IX and other civil rights laws may be directed to the Human Resources Director, Indiana Department of Education, Room 229, State House, Indianapolis, IN 46204-2798, or by telephone to 317-232-6610, or the Director of the Office for Civil Rights, U.S. Department of Education, 111 North Canal Street, Suite 1053, Chicago, IL 60606-7204—Dr. Suellen Reed, State Superintendent of Public Instruction.